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Comment on acp-2021-876

Anonymous Referee #2

Referee comment on "The impacts of marine-emitted halogens on OH radicals in East Asia during summer" by Shidong Fan and Ying Li, Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2021-876-RC2, 2021

The authors present a study of the effects of halogen chemistry on the concentrations and production rates of OH radicals in the East Asia region in July 2019 using the CMAQ model with WRF meteorology. The methodology applied is appropriate to the study, and the results will be of interest to the atmospheric science community.

The emission schemes and chemical mechanisms for halogens (Cl, Br, and I) employed in the model are generally well described, and there is some comparison of model results with observations of halogen species where these are available. However, the manuscript would benefit from some additional discussion of the uncertainties in the mechanisms with a view to highlighting which processes in the model should be targeted for improvements that will reduce model uncertainty.

Similarly, how do uncertainties in measurements (or in the availability of measurements) impact tests of model performance and the model results? Are there key species or locations which should be targeted for future observations that would help to validate models?

Can the authors comment on any expected seasonal effects? How representative are the conditions in July 2019 of other summer months and of other years?

Are there any impacts of halogens on OH loss processes as well as processes involved in the production of OH.

Is it possible to comment on the wider significance of the results? What do the results imply about our understanding of methane lifetimes for example?

More specific comments are given below:

Line 33: HO2 should not really be considered as a source of OH owing to its production via OH reactions.

Line 37: Define NOx and the concentration range used to define the low NOx regime. Note that the studies mentioned in which modelled OH concentrations are underestimated typically have both low NOx and high biogenic VOCs. It's not clear that these studies are relevant to marine regions.

Lines 56-69: The chemistry HO2 + XO and HO2 + NO was included in previous studies and the impacts were thus considered as part of the overall effects.

Line 100: Is a 10 day period appropriate to spin-up any long-lived species in the model?

Line 113: It would be preferable to reference a peer-reviewed result rather than a figure in a preprint version.

Lines 237, 252, 265: Although HOX photolysis is potentially a primary source of OH, it may also be considered a secondary source if significant HOX is produced via HO2 + X since HO2 is primarily produced via OH chemistry. It would be helpful if the authors could comment on the relative importance of chemical production of HOX and direct emission of HOX. What fraction of OH is produced via photolysis of HOX?

Line 242: Please clarify the meaning of FORM + O. Is there any impact of halogen chemistry on formaldehyde?

Line 259: Changes in OH and HO2 have been considered as part of the net result in previous CTM studies, it isn't really correct to say that these changes were ignored.

Line 260: The box model studies do provide accurate model results, but they are typically directed at different processes and different timescales. It is not really correct to say that a model is not accurate.

Line 368: Are the changes to the photolysis of HOX and HO2 + Y linked via HO2 + X?

Line 302 onwards: Please show the charges on ionic species.

Line 411: Is it possible to perform any sensitivity analysis to HO2 uptake?

There are also a number of language improvements that should be corrected. Some of these are listed below:

Title: This would read better as ‘on OH radicals’ or ‘on the OH radical’.

Line 9: ‘Hydroxyl (OH) radical... OH’ to ‘hydroxyl (OH) radicals... The OH’.

Line 11: ‘OH level’ to ‘OH levels’.

Line 16: ‘response of OH’ to ‘response of the OH’.

Line 23: ‘while increase’ to ‘while increasing’.

Line 25: ‘the southern’ to ‘southern’.

Line 26: ‘the coastal’ to ‘coastal’.

Line 31: ‘Hydroxyl’ to ‘The hydroxyl’.

Line 32: Define VOCs, ‘produce’ to ‘producing’.

Line 34: ‘O1D’ to ‘O(1D)’, ‘At urban’ to ‘In urban’.

Line 44: ‘impact’ to ‘impacts’, ‘The marine-emitted halogen’ to ‘Marine-emitted halogens’.

Line 50: ‘long-term’ to ‘long-lived’.

Line 53: Define HOx.

Line 54: ‘CTMs studies’ to ‘CTM studies’.

Line 81: It would help to define CMAQ and WRF in full.

Line 89: ‘mechanisms’ to ‘mechanism’.

Line 90: ‘Rosenbrock’ to ‘The Rosenbrock’.

Line 105: ‘inline’ to ‘online’?

Line 134: ‘global annual’ to ‘by global annual’.

Line 161: ‘though’ to ‘although’, ‘in-situ’ to ‘in situ’, ‘area is’ to ‘area are’.

Line 164: ‘BrO and IO very’ to ‘BrO and IO are very’.

Line 165: ‘IO concentration’ to ‘the IO concentration’.

Line 166: ‘Western Pacific’ to ‘the Western Pacific’.

Line 171: ‘largest’ to ‘the largest’, ‘while smallest’ to ‘and the smallest’.

Line 184: ‘average’ to ‘the average’.

Line 189: ‘related to O3’ to ‘related to the O3’.

Lines 203, 204, & 207: ‘slight’ to ‘a slight’.

Line 205: ‘decrease’ to ‘a decrease’.

Line 206: ‘increase’ to ‘an increase’.

Line 208: ‘while increase’ to ‘while increasing’.

Line 225: ‘literature’ to ‘the literature’.

Line 235: ‘CB6’ to ‘the CB6’.

Line 236: ‘source’ to ‘sources’.

Line 251: ‘whole’ to ‘the whole’.

Line 252: ‘daytime’ to ‘the daytime’.

Line 311: ‘daytime maximum’ to ‘the daytime maximum’.